# Electronic Records

## Introduction

Electronic record-keeping is a reliable, cost effective means of managing information resources. Increasing volumes of data have been converted into computerized applications, paving the way for advances in the field of information management.

## Objective

The objective of an electronic records management program is to process data efficiently through policies and procedures that address data input, storage, and output.

## Preliminary Issues

### Advantages of Electronic Record-keeping

Conversion of paper records to data and electronic formats has many cost-justifiable benefits, including:

1. Ability to develop data processing systems using personal computers
2. Reduction of manual labor requirements
3. Storage of vast quantities of data in a few square feet of space
4. Rapid data input and retrieval
5. Multiple user access

Despite such advantages, procedural and technical controls are needed to ensure effective maintenance because electronic data can be lost, altered or deleted much more readily than data stored on traditional media such as paper or microfilm. Converting from manual to electronic records systems does not eliminate records management concerns. Magnetic tapes, floppy disks, and optical disks use these systems to record information and are no less records than traditional paper or microfilm. Moreover, conversion to electronic recordkeeping can adversely affect the accessibility of records and the archival quality of the systems themselves. **The medium in which information is stored does not eliminate statutory or regulatory requirements for scheduling, maintaining, and disposing of public records.**

Document management tools have been developed to aid in determining the best methods for converting from paper to a data- or image-processing environment.

## Records and Information Management

With the proliferation of information being produced, agencies must have the tools to ensure that it will be effectively used, including data, information, and knowledge management.

## Data Management

It is not just enough to collect data for grouping and storage in a database. Data collection must have structure and relevance to the agency and be easily accessible to multiple users. It must be updated, routinely maintained, and backed-up or it will lose its value to an agency. Data collected and generated by an agency is its most valuable asset because it documents the daily course of business. Data management application tools can be employed to protect it and ensure its continued accessibility.

## Information Management

Using a database as a foundation, information management combines and analyzes data for forecasting and decision-making. Data is no longer viewed as a collection of names and amounts; value is placed upon the innovative use and application of the data as information. Software can be purchased that supports information management applications.

## Knowledge Management

Knowledge management looks at the volume of information generated and its relevance and relationship to the patterns, procedures and rules within an agency through tools that redirect the focus from the individual data to its overall role with users and processes. Information is seen as knowledge and exists in two forms: *explicit* and *tacit*. Explicit knowledge can be coded and distributed; whereas tacit knowledge is subjective and intuitive. Knowledge management sees information as being: *intermediate*, a relationship between provider and seeker; *internal* and *external*, contained and distributed within the agency and distributed outside to the users; *cognitive*, knowledge derived from the preceding which aids in decision-making; and *measurement*, the ability to quantify and measure the results. Workflow processes and design tools are often used in conjunction with knowledge management.

# Planning and Selection

## Workflow and Business Process Re-engineering (BPR)

In addition to employing the various management theories, agencies may seek to conduct Workflow and Business Process Re-engineering (BPR) studies for further analysis of their operational procedures prior to conversion to electronic record-keeping. Workflow studies evaluates business processes from execution to completion and the means by which to automate and improve them. It encompasses ideas such as document scanning and conversion, information and document multi-accessing and -routing, task and transaction analysis, mail merge, customer service, and groupware utilization. Business process re-engineering works in tandem with workflow studies to analyze an agency's business processes and determine their relevance and identify the methods and technologies available to improve them .

## Feasibility Study

***Feasibility studies*** are an effective method for an agency to determine if an optical disk system meets their records and information management needs or whether another technology, such as microimaging, would be more appropriate and cost-justifiable. These studies can provide an

agency with valuable insight and clarify recordkeeping objectives before a vendor is actively consulted. The feasibility study should consist of:

1. **General agency overview:** state agency mission, identify record series considered for conversion, target deficiencies in the records management system, and state rationale for seeking alternate technology

2. **Current System:** describe record series, procedures to manage record series, record series usage records disposition procedures, filing schemes, data processing interfaces, and record-keeping costs

3. **Success Factors:** needs statement and success factors resulting from data conversion

4. **Preliminary Evaluation:** criteria for alternate records system based on success factors and budgetary constraints, records hierarchy listing

5. **Alternate Technology:** list filing and storage methods and indexing adjustments needed, microimaging alternatives and electronic imaging employed

6. **Analysis of Alternatives:** conduct analysis of each alternative system and their costs/benefits

7. **Evaluation and Choice:** evaluate and eliminate systems that fail to meet criteria, and rate remaining systems

8. **Choose a system**

## Request for Proposal (RFP)

Upon review and acceptance of the results of the feasibility study, agencies are ready to submit a Request for Proposal (RFP) to solicit vendor responses regarding their products. By conducting a feasibility study first, agencies provide themselves with a detailed picture of their current operational procedures as well as a guide for future needs, which will become part of the RFP. The RFP provides a valuable tool for system justification and authorization, and supplies an audit trail documenting hardware and software purchases. It also helps in the vendor/system evaluation process and may be used as a device to monitor vendor performance and adherence with system specifications and requirements. The basic outline for the RFP should include:

1. **System objectives:** the operational, employee productivity, and customer services benefits to be gained and problem areas to be eliminated by converting existing procedures to an automated environment

2. **Technical requirements: a** realistic view of the hardware and software needed to achieve system objectives, avoiding parameters that may be too costly, restrictive, or open-ended

3. **Project Management: the process by which** system migration, installation, testing, training, and upgrading will all occur

4. **Evaluation of Supplier(s):** the number of previous systems designed, years of

operation, etc.

5. **Pricing:** associated costs for hardware, software, training, and technical support

6. **Support:** maintenance and software upgrades, continuous training, enrollment in user groups

7. **Contracts & Licenses:** the final contract to obtain or lease the system hardware and software and licenses for the specified number of users

**Agencies must critically review each proposed system to ensure that it conforms with the agency's stated objectives instead of driving the agency's needs.**

## Technical Expertise: Data and Image Processing

The identification of knowledgeable individuals associated with the creation, maintenance and disposition of computer systems and electronic records is essential. Local agencies may obtain technical assistance from the Information Technology Center (ITC) housed within the Department of the Treasury, Office of Information Technology (OIT), for expertise in system and application design, enhancement, and operations; and hardware and software procurement.

For advice in evaluating the desirability of acquiring an automated record image processing system, agencies should consult N.J.A.C. 15:3-3-4, Image Processing of Public Records; N.J.A.C. 15:3-5, Certification and Annual Review Image Processing Systems; and AIIM TR27 - 1991 Electronic Imaging Request for Proposal (RFP) Guidelines, as well as other national and international standards.

# Alternative Technologies

When converting to electronic records, several technologies provide unique advantages over storing data exclusively on magnetic media or paper. But before one is chosen, agencies should: 1) dispose of obsolete records by submitting destruction requests in accordance with appropriate retention schedules, and 2) convert paper records to microfilm. These procedures will help determine when a alternative technology is the best method for preserving and storing certain information. Only through this means will the expense of a technology become cost-effective.

The objective of using a supplemental or alternative technology is to enhance records storage and retrieval methods by linking a computer with nonmagnetic storage media. Among the various methods available, the three most-often used techniques are: image processing, microimaging, and Computer Output to Microfilm (COM).

# Image Processing

With image processing, documents are scanned, converted into digitized data, and recorded onto a disk. Because this process uses a highly-focused laser beam to record and read information, it can store large quantities of data in a small space. The disk consists of a base, recording material, glass or plastic housing, and a plastic cartridge enveloping the disk to prevent surface damage. Depending upon the disk type, the processes and materials used may vary from metal alloy, to plastic, and to glass, but all adhere to a standard format.

## System Variations

**WORM** (write-once-read-many) uses one of three techniques for data storage. In one, a laser ablates or burns a series of small pits in the surface of the medium, exposing a reflective layer of substrate. In another, a laser applied to a metal overlay heats an underlying polymer and generates gases which push up on the metal and create bubbles; and in the third technique the laser melts two metals forming an alloy with a different reflective property. The disk can then be read by a low-power laser. As stated in N.J.A.C. 15:3-4.3, *Image Processing of Public Records*, WORM systems are preferred for use with long term and permanent records. WORM shelf life has been rated at 200 years.

**CD-ROMs** (read-only memory) were originally produced only by commercial vendors for high-volume market usage, but can now be reproduced by the users. The shelf life for various types of CD-ROMs varies from 10 to 200 years. Although the CD-ROM has become a de-facto standard for many optical disk applications, the Digital Video/Versatile Disk (DVD-ROM) is now challenging its continued use.

**Erasable optical disk** technology, which allows data to be written (entirely or in segments) and erased from memory, is the subject of much commercial research and development. This system raises serious questions regarding the issue of records integrity because the source image can be altered and deleted from its original form. Also of concern is the issue of the lack of compatibility between the various systems which include: CD-Erasable (CD-E), CD-Recordable (CD-R), and CD-ReWritable (CD-RW).

**Magneto-optical** or **thermo-magneto-optical** rewritable disks are recorded magnetically and read by a laser. Composed of glass or plastic, the disks are coated with a metal alloy layer known as rare-earth and transition metals (RETMs). The shelf life for magneto-opticals has been rated up to forty years. But, like other magnetic media, magneto optical can degrade due to magnetic fields and therefore is unreliable for long-term or permanent records storage.

**Phase change** rewritable disks use lasers to change their chemical properties, such as from a crystalline to an amorphous state, for recording data. The shelf life for phase change optical disks is approximately thirty years.

## Advantages of Image Processing

By digitizing documents through image processing, record-keeping systems gain through:

1. **Fast processing of documents**

2. **Fast retrieval of documents**

3. **Extremely high volume of images stored on each disk**

4. **Enhancement capability**: digitized images can be augmented before printing

5. **Legal precedent in accordance with state standard** New Jersey courts accept optical disk facsimiles as legal substitutes for original documents, provided they are in compliance with state-issued standards for image processed records (N.J.A.C. 15:3 et seq.).

## Disadvantages of Image Processing

Some of the intrinsic deficiencies directly attributable to image processing technology include:

1. **Non-archival status**: Many optical disks have short life spans, are technology dependent, suffer continued equipment durability and obsolescence, and must comply with standards

2. **Legal original or facsimile**: New Jersey courts accept original and their facsimiles as a legal substitute, provided they are both in compliance with state-issued standards for image processed records (P.L. 1994, c. 140). Noncompliance could place an agency in legal jeopardy, resulting in costly sanctions.

3. **High costs**: High costs of hardware and software, preparation, indexing, classification, and supplies, must be considered when evaluating an image-processing system.

4. **Forgery potential**: Provided that appropriate software is available, portions of an image may be electronically copied and grafted onto portions of another image to create a new image. By altering the index pointers that allow access to them, only the final image will be accessible.

5. **Life Expectancy (LE)**: Although competing manufacturers attest to the longevity of optical disks, microfilm has a greater proven life span of over 500 years. Given these apparent limitations, image processing seems to be best suited to extremely voluminous, active records systems with retention periods of ten years or less.

# Microfilm and Microfilm Scanning

Due to the increased importance of microfilm and its concurrent usage with image processing systems, agencies seeking to initiate microfilming and microfilm scanning projects should consult with the Division of Archives and Records Management to ensure compliance with revised microfilming system standards as promulgated in N.J.A.C. 15:3 et seq.

# Computer Output Microfilm (COM)

Computer output microforms are produced directly from a computer without a paper document. The recorder takes machine-readable data from a computer and converts it directly into human-readable data, most often on 4" x 6" (105mm x 148mm) microfiche sheets. Microfiche contain an eye-readable title row, up to 269 data frames and an index frame. COM can also be recorded on roll microfilm. Most items can be accessed on microfilm reader/printers in approximately ten seconds. As in any microphotography, for long-term retention of more than ten years, heat-processed silver halide film should be used for master copies (see section V - 4). For short-term retention, low-cost diazo or vesicular film is adequate.

## Advantages of Computer Output Microfilm

Under appropriate circumstances, use of COM provides cost savings in computer time, information distribution, retrieval time, and storage space. COM is a faster and more economical data output medium than paper printouts because computer-output is:

1. Converted into human-readable text at speeds up to 342 computer pages per minute

2. Recorded on microforms that may be rapidly duplicated in quantity

3. Recorded on microforms at character reduction ratios that are 24, 42 or 48 times smaller than those produced by traditional printing methods, permitting storage of massive amounts of information in a small amount of space.

## General Guidelines for Cost-Effectiveness

As its most obvious advantage, Computer Output Microfilming reduces paper output and consequently takes up much less storage space. COM is generally *most* cost-justifiable when computer printouts:

1. Have fifty or more pages each

2. Require multi-ply paper or duplicates

3. Are produced frequently and routinely

4. Are distributed widely and mailed

Computer Output Microfilming is ***least*** cost-justifiable when computer printouts:

1. Are produced only occasionally

2. Have few pages

3. Have several pages that need to be examined at the same time

4. Are hand-corrected or annotated.

# Electronic Records Conversion and Management

## Converting Legacy Systems

While often serving as the backbone of an information system, legacy systems can become outdated and problematic to maintain. As an agency and its responsibilities grow, its technology and continued access to its information must keep pace; otherwise an agency will fall behind. Converting a legacy system to a new system can be an intimidating task for both the information professional and nonprofessional. The conversion process is costly and time consuming and usually takes *one to five years* to accomplish, depending on its complexity. Extensive research and planning is vital for the conversion of the hardware, software, and data and should be recognized as a collective effort between records management and information systems staff to ensure a smooth transition and gain support and valuable input from the users among agency staff.

Prior to the conversion process the active and inactive data should be analyzed. Data that is

outdated and whose retention periods have expired should be best purged, and active data should be inventoried. Documentation should be written to serve as a hardcopy data index log that mirrors its online version.

The conversion process may best be implemented in small increments. A section should be converted and tested and documented that way the rest of the system will not be affected by the change. Thorough documentation should be kept to record the conversion process from start to finish to already allow for future expansion.

## Backfile Conversion

One of the most important and overlooked aspects of records conversion is backfile conversion. While caught up in the excitement of new technology migration, personnel have a tendency either to downplay the conversion of the "legacy files" or to postpone it until the new system is up and running, leaving important old data inaccessible. During system migration planning, agencies often minimize the time and staff required for backfile conversion.

Backfile conversion addresses the same considerations that any other conversion process would require: document preparation, indexing, scanning, quality control /reporting, and media output. If limited staff availability for scanning is an issue, agencies have the option of outsourcing backfile conversion to a private service bureau for document scanning or microfilm scanning. But these options should be considered before planning a Request for Proposal (RFP).

## Pre- and Post-Implementation Considerations

Local agencies and authorities should become aware of some specific considerations of electronic records management. Critical areas of concern include:

1. Evaluating and organizing manual records prior to conversion to electronic records

2. Creating documented procedures that address retention and disposition of electronic records

3. Coordinating manual and electronic records systems

4. Developing methods of electronic data retrieval and use

5. Protecting vital data files, applications and system programs, and supporting documentation

6. Establishing security to maintain privacy and confidentiality

7. Developing systems in accordance with state standards for image processing (N.J.A.C. 15:3)

8. Preserving information that has long-term research and historical value

9. Monitoring the life span of software and technologies related to electronic record-keeping systems

10. Replacing or updating obsolete hardware and software

## Compatibility

Offices often purchase a computer without considering open system compatibility. This causes problems that range in scope from purchasing useless supplies to major errors such as acquiring inappropriate hardware. Such inefficiencies waste tax dollars. Whenever agencies propose a new system, they should show a preference for systems based on open architecture. Given constraints on state government resources, officials should consider:

1. Compatibility of a legacy system with current and anticipated system upgrades

2. Interchangeability of system hardware

3. Compatibility of the operating system and pre-packaged software

4. Ease of operation and understanding

5. Capability of upgrading hardware and software given budgetary levels

6. Appropriateness of a system to perform the level of tasks required by an organization

## Documentation Manual

The documentation manual provides an understanding of a system's technical components and system design and structure. It should be created to provide information pertaining to: customized system and application programs source code, off-the-shelf software, data files used by the programs, program revisions, system upgrades, back-up procedures, file management, disaster prevention/recovery and security, object code, applications development documents, computer file listings, input-output procedures, and operating system and hardware specifications. The manual should be revised on a regular basis. Regardless of its source, computer system documentation should be maintained, updated, and indexed. Documentation ensures data integrity and provides compatibility information for open-system expansion. It also provides critical knowledge for media care, handling and storage.

## Implementation and Maintenance: Basic Guidelines

In accordance with the state-issued standards for image processing, N.J.A.C. 15:3-4 et seq., agencies currently employing or considering conversion from paper records to electronic records should observe the following:

1. Conduct a feasibility study to determine if an imaging system is the most appropriate and cost-effective for meeting records management.

2. Establish systematic, comprehensive records management guidelines for paper, microimage, and image-processed records through use of state-issued records retention schedules and records disposition forms.

3. Consult the standards for image processing N.J.A.C. 15:3-4, *Image Processing for Public Records*, to ensure that existing systems are in compliance and have been certified and

that proposed systems will be in compliance for certification.

4. Develop and implement routine magnetic tape refreshing and optical media backup procedures.

5. Create and periodically test disaster prevention/recovery plans for storage media, hardware, and software.

6. Plan during the initial development stage, a migration path for system software and hardware upgrades, which should include the creation of a history file with copies of old and new system documentation and software.

7. Ensure that yours is an "open architecture" system with nonproprietary hardware and software.

8. Be wary of claims regarding new technologies without track records or standards.

9. Create a structured and documented data index, data is useless if it cannot be accessed or searched.

10. Use high-quality hardware and software for your entire system and avoid excessive handling of the software.

11. Permanent and long-term records with retentions of ten years or longer maintained on optical disk may require hardcopy or microfilm backup copies according to state laws and regulations; consult N.J.A.C. 15:3-4 et seq., Image Processing for Public Records.

## Care and Handling Guidelines

Because electronic data can be lost, altered or deleted much more readily than data stored on traditional media, extraordinary care must be taken with storage and handling. The continuous interaction between a record's medium and the environment in which it is kept determines the severity and rate of records deterioration. As cited in N.J.A.C. 15:3-6, *Storage of Public Records*, the magnetic tapes and disks of automated systems must be kept in a manner that protects them from the principal hazards of:

1. **Excessive fluctuations of temperature and humidity** — High ranges of heat and humidity cause magnetic tapes to become unstable. Fluctuations of temperature and humidity cause tapes and disks to swell and contract with each climatic cycle, adversely affecting the conformity of their oxide coatings, thus shortening their life cycle

   Preventive measures include installation of ventilation and heating ducts, air conditioners or dehumidifiers to remove excess moisture from the air and keep the relative humidity of storage areas within a range of 40 percent and temperature at 62 - 68 $^{o}$ F, year round. Temperature and humidity tolerances vary according to equipment type, size and manufacturer. Manufacturers' equipment manuals should be consulted for appropriate recommendations. Instruments such as thermohygrometers and psychrometers should be used to monitor temperature and fluctuating humidity within the storage room, and repository surveys should be completed during these periodic inspections (see Appendix C) affected by direct or indirect contact.

To prevent accidental erasure, tapes and floppy disks must be kept away from sources of magnetic energy. Computer rooms are undesirable storage areas because of the high magnetic fields in use during operations of tape units. However, if no separate storage areas are available and tapes and disks are kept in a computer room, they should be stored at least two feet away from the hardware, preferably in a well-segregated area.

2. **Contamination by dust and other airborne impurities** — Dirt and dust pose a long-term hazard to all records. Accumulated dust and debris will contaminate disk or tape reels, eventually corroding record materials. In a storage area with high temperature and humidity, sulfides and nitrates from automobile exhaust can convert to sulfuric acid or nitric acid. Control measures include daily damp mopping of floors and daily vacuuming of floors and selected equipment such as printers, bursters, and decollators. In areas where disks or tapes are stored, avoid cleaning with metal abrasives such as steel wool, sweeping, dry mopping, or dusting. Additionally, floors should be waxed as little as possible, no more than once or twice per year. Other steps include installation and regular cleaning of air filters in heating and cooling ducts.

3. **Excessive or improper handling** — Although it is highly unlikely that magnetic tapes or cassettes will be erased accidentally be energy sources or magnetic fields, tape surfaces can be significantly affected by direct and indirect contact.

4. **Protection against fire, flood, and theft: a** disaster prevention/recovery plan should be implemented and routinely tested to safeguard magnetic tapes and disks.

5. **Data security measures**: identifying specific user access or restriction to specific menus, screens, documents, applications, and functions.

Some handling considerations include ***eliminating:***

a. Exposed disk or tape reel containers

b. Storing tapes on top of a tape or disk drive, to avoid heat and dust from blowers

c. Erasure of tape identification labels

d. Trailing loose tape ends

e. Flat storage or stacking of tapes or disks, to avoid warping or accidental damage

f. Food, drink and smoking

Other handling considerations include ***encouraging*** the use of:

a. Storage in a closed cabinet or shelf elevated from the floor and segregated from source paper and card dust

b. Use of tape-end retainers to prevent unwinding

c. Regular cleaning and precision winding to prolong life and decrease deterioration

d. Use of anti-static mats

## Outsourcing of Services: Optical Disk and COM

Despite the cost-effectiveness of converting to either image processing or COM, the costs associated with their initial setup and conversion (including scanning of backfile documents) are high. If the volume, access, and retention of records justify the use of these technologies, agencies should investigate options to be used in conjunction with equipment purchases and in-house production, such as outsourcing to a private vendor for production services.

Through outsourcing, service vendors can provide agencies with state-of-the-art hardware and software and highly skilled personnel onsite or offsite, depending upon agency needs as contracted. This service can save an agency time and money by eliminating the disruption of the normal flow of business and further enhance productivity and flexibility. Issues such as security; confidentiality; document ownership, retention and disposition, and disaster prevention/recovery should be given careful consideration when making a vendor selection to ensure quality control, service, and adherence to state and federal public records laws, standards, rules, and guidelines.

## Summary

Converting data to electronic format has many cost-justifiable advantages for the public sector. Government officials have become aware of the attributes of electronic records management and the elements necessary for establishing control over automated systems.

Electronic records programs may center upon record inventories and records retention schedules, documentation standards, and information processing administration. Additionally, an organizational perspective that includes the concerns of all affected offices is imperative.

Under certain conditions, supplementing records systems through appropriate technologies has cost-justifiable advantages for the public sector. Public officials should become aware of the specific advantages of alternative and supplemental technologies and their potential applications.

A **feasibility study** that incorporates records inventory, appraisal, and scheduling will help determine when an alternative technology is the best method for preserving and storing certain information and provide a foundation for issuance of a **Request for Proposal** for vendor and system selection.

Consultations or assistance on electronic record-keeping issues is available free of charge to local agencies and authorities. Call the Bureau of Records Management at (609) 530-3200 and the Bureau of Micrographics and Alternative Records Storage at (609) 530-3234, or write: New Jersey Department of State, Division of Archives and Records Management, P.O. Box 307, Trenton, New Jersey, 08625.